

Cloud products from the Directional Polarimetric Camera: algorithms, results and evaluation

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Clouds, covering more than 50%–70% of our planet's surface, it play an important role in warming and cooling the earth during energy exchange so that the Earth's temperature is maintained for human survival. The accurate cloud products will directly affect the credibility in the climate change, environmental monitoring and meteorological forecast [1]. The Directional Polarimetric Camera (DPC) is the first Chinese multi-angle polarization earth observation instrument, which was launched onboard the Gaofen-5 satellite in 2018 [2].

We present the physical basis of the DPC cloud products algorithms, results and the evaluation to their performance. Since May 2018, the DPC has been providing global observations of the solar radiation reflected by the Earth's atmospheric system with its 3 polarized channels (490, 670, and 865 nm) together with 5 non-polarized channels (443, 565, 763, 765, and 910 nm) at each angle (up to 9 angles), and the spatial resolution is 3.3 km at nadir under a swath width of 1850 km [3]. A series of algorithms have been developed to generate the standard DPC Level 2 Cloud Products that include cloud mask, cloud phase and cloud optical thickness, etc. The DPC cloud mask adopts dynamic thresholds (no single fixed value) obtained by simulation for different atmospheric models and underlying surfaces in different time and areas [4]. Based on the different applications for cloud mask, we have constructed a set of cloud confidence evaluation criteria. The DPC cloud phase is distinguished by specific characteristics that liquid cloud droplets exhibit a polarization rainbow for scattering angles near 140° at 865 nm [5]. The DPC cloud optical thickness is derived from the total solar radiance of the 670 nm channel over the land and 865 nm channel over the ocean. Comparison with the cloud products from the Moderate Resolution Imaging Spectroradiometer and the Cloud–Aerosol Lidar with Orthogonal Polarization instruments shows that the DPC cloud products algorithms are performing well and the accuracy has reached the theoretical expectation.

References

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